

IN THE CLAIMS:

Please add new claims 34 through 42, and amend claims 1, 4, 7, 8, 9 and 25 — all as set forth below.

1 1. (currently amended) Apparatus for printing a desired
2 image on a printing medium, based upon input image data, by
3 construction from individual marks of at least one colorant,
4 formed in a pixel grid; said apparatus comprising:

5 for each colorant, at least one respective multielement
6 ~~incremental-~~ printing array that is subject to colorant-depo-
7 sition error;

8 means for measuring such colorant-deposition error of the
9 at least one array;

10 means for modifying a multicolumn, multirow numerical
11 tabulation that forms a mapping between such input image data
12 and such marks, to compensate for the measured colorant-depo-
13 sition error; and

14 means for printing using the modified mapping.

1 2. (original) The apparatus of claim 1, wherein the mapping
2 is selected from the group consisting of:

3 an optical-density transformation of the image data to
4 such construction from individual marks; and

5 a spatial-resolution relationship between the image data
6 and such pixel grid.

1 3. (original) The apparatus of claim 2, wherein:

2 the optical-density transformation comprises a halftoning
3 matrix; and

4 the spatial-resolution relationship comprises a scaling
5 of the image data to such pixel grid.

1 4. (currently amended) The apparatus of claim 1, wherein:

2 said at least one multielement ~~incremental~~ printing ar-
3 ray comprises a plurality of multielement printing arrays that
4 print in a corresponding plurality of different colors or col-
5 or dilutions, respectively, each multielement printing array
6 being subject to a respective colorant-deposition error; and

7 the measuring means and the mapping-modifying means each
8 operate with respect to each one of the plurality of multiele-
9 ment printing arrays respectively.

1 5. (original) The apparatus of claim 4, wherein:

2 for at least one of the plurality of multielement print-
3 ing arrays, the colorant-deposition error comprises a respec-
4 tive pattern of printing-density defects; and wherein:

5 the measuring means comprise means for measuring the
6 pattern of printing-density defects for each multielement
7 printing array respectively; and

8 the modifying means comprising means for applying the
9 respective pattern of defects, for at least one of the mul-
10 tielement printing arrays, to modify a respective said map-
11 ping.

1 6. (original) The apparatus of claim 4, wherein:

2 for at least one of the plurality of multielement print-
3 ing arrays, the colorant-deposition error comprises a swath-
4 height error;

5 the measuring means comprise means for measuring the
6 swath-height error for each multielement printing array re-
7 spectively; and

8 the modifying means comprise means for applying the
9 respective swath-height error, for at least one of the
10 multielement printing arrays, to modify a respective said
11 mapping.

1 7. (currently amended) The apparatus of claim 1, wherein:

2 the colorant-deposition error comprises a pattern of
3 printing-density defects;

4 the measuring means comprise means for measuring the
5 pattern of printing-density defects;

6 the modifying means comprise:

7
8 means for deriving a correction pattern from
9 the measured pattern of printing-density de-
10 fects, and

11
12 means for applying the correction pattern to modify
13 a halftone thresholding process; and

14
15 for each colorant, the printing means comprise means for
16 printing such image incrementally, using the modified halftone
17 thresholding process.

1 8. (currently amended) The apparatus of claim 1, wherein:
2 the colorant-deposition error comprises a swath-height
3 error or otherwise corresponds to an optimum distance of
4 printing-medium advance;

5 the measuring means comprise means for measuring the
6 swath-height error or determining the optimum distance;

7 the modifying means comprise:

8
9 means for deriving a correction pattern from the
10 measured swath-height error or determined opti-
11 mum distance, and

12
13 means for applying the correction pattern to modify
14 a halftone thresholding process; and

15
16 for each colorant, the printing means comprise means for
17 printing such image incrementally, using the modified halftone
18 thresholding process.

1 9. (currently amended) A method of printing a desired image,
2 by construction from individual marks of at least one color-
3 ant, formed in a pixel grid by at least one multielement
4 printing array that is subject to a pattern of printing-den-
5 sity defects; said method comprising the steps of:

6 measuring such pattern of printing-density defects;

7 deriving a correction pattern from the measured pattern
8 of printing-density defects;

9 applying the correction pattern to modify a halftone
10 thresholding process; and

11 for each said colorant, printing such image by said at
12 least one multielement array respectively, using the modified
13 halftone thresholding process.

1 10. (original) The method of claim 9, for use with a print-
2 mask in plural-pass printing, and further comprising the steps
3 of, before or as a part of the applying step:

4 using such printmask to determine a relationship between
5 the halftone matrix and the multielement array; and

6 employing the relationship in the applying step to con-
7 trol application of the correction pattern to the halftone
8 matrix.

1 11. (original) The method of claim 9, wherein:

2 the printing step comprises single-pass printing.

1 12. (original) The method of claim 9, for use with said at
2 least one multielement incremental-printing array that com-
3 prises a plurality of scanning multielement printing arrays
4 that print in a corresponding plurality of different colors or
5 color dilutions, each multielement printing array being sub-
6 ject to a respective swath-height error; and wherein:

7 the measuring, deriving, applying and printing steps are
8 employed to modify swath height of at least one of the scan-
9 ning multielement printing arrays, for accommodating any
10 swath-height error present in each multielement printing array
11 respectively.

1 13. (original) The method of claim 9, for use with said at
2 least one multielement incremental-printing array that compri-
3 ses a plurality of multielement printing arrays that print in
4 a corresponding plurality of different colors or color dilu-
5 tions, each multielement printing array being subject to a
6 respective pattern of printing-density defects; and wherein:

7 the measuring, deriving, applying and printing steps are
8 each performed with respect to each multielement printing
9 array respectively.

1 14. (original) The method of claim 13, for use with such
2 plurality of multielement incremental-printing arrays that are
3 also each subject to a respective swath-height error; and
4 wherein:

5 the measuring, deriving, applying and printing steps are
6 also employed to modify swath height of at least one of the
7 multielement printing arrays, for accommodating any swath-
8 height error present in each multielement printing array
9 respectively.

1 15. (original) The method of claim 9, wherein:

2 the halftone thresholding process comprises definition of
3 a halftone matrix.

1 16. (original) The method of claim 9, wherein:

2 the halftone thresholding process comprises an error-
3 diffusion protocol.

1 17. (original) The method of claim 16, wherein the error-
2 diffusion protocol comprises at least one of:

3 a progressive error-distribution allocation protocol of
4 such error-diffusion halftoning; and

5 a decisional protocol for determining whether to mark a
6 particular pixel.

1 18. (original) The method of claim 9, wherein:

2 the applying step comprises replacing values above or
3 below a threshold value.

1 19. (original) The method of claim 9, wherein:
2 the applying step comprises multiplying values by a
3 linear factor.

1 20. (original) The method of claim 9, wherein:
2 the applying step comprises applying a gamma correction
3 function to values.

1 21. (original) The method of claim 9, wherein the modifying
2 step comprises a combination of at least two of:
3 replacing values above or below a threshold value;
4 multiplying each values by a linear factor; and
5 applying a gamma correction function to values.

1 22. (original) The method of claim 9, wherein:
2 for each of the plurality of multielement arrays, the
3 measuring, deriving and applying steps are each performed at
4 most only one time for a full image.

1 23. (original) The method of claim 9, wherein:
2 the applying step comprises modifying the darkness of
3 substantially each mark printed by an individual printing
4 element whose density is defective.

1 24. (original) The method of claim 9, wherein:

2 the applying step comprises modifying the average number
3 of dots printed by an individual printing element whose den-
4 sity is defective.

1 25. (currently amended) A method of printing a desired im-
2 age, based on input image data, by construction from individu-
3 al marks of at least one colorant, formed in a pixel grid by
4 at least one scanning multielement printing array; said print-
5 ing being subject to print-quality defects due to departure of
6 printing-medium advance from an optimum value; said method
7 comprising the steps of:

8 measuring a parameter related to such print-quality
9 defects;

10 based on the measured parameter, scaling such input image
11 data to compensate for said departure; and

12 for each said colorant, printing such marks with said at
13 least one scanning multielement array image using the scaled
14 input image data.

1 26. (original) The method of claim 25, wherein:

2 the parameter comprises such print-quality defects; and

3 the measuring step comprises measuring such print-quality
4 defects.

1 27. (original) The method of claim 26, wherein:

2 the defects comprise swath-height error; and

3 the measuring step comprises measuring swath-height
4 error.

1 28. (original) The method of claim 26, wherein:
2 the defects comprise area-fill nonuniformity; and
3 the measuring step comprises:

4
5 using a sensing system to measure area-fill non-
6 uniformity for plural printing-medium advance
7 values, and

8
9 selecting a printing-medium advance value that cor-
10 responds to minimum area-fill nonuniformity.

1 29. (original) The method of claim 25, wherein:
2 the parameter comprises such optimum value; and
3 the measuring step comprises determining such optimum
4 value.

1 30. (original) The method of claim 25, for use with said at
2 least one scanning multielement printing array that comprises
3 a plurality of multielement printing arrays that print in a
4 corresponding plurality of different colors or color dilu-
5 tions, each multielement printing array being subject to a
6 respective swath-height error; wherein:
7 the measuring, scaling and printing steps are each per-
8 formed with respect to each multielement printing array re-
9 spectively.

1 31. (original) The method of claim 30, wherein the printing
2 step comprises:

3 comparing optimum advance values or swath-height values
4 measured for the plurality of multielement printing arrays
5 respectively, to find the smallest of said values;

6 selecting a particular multielement printing array whose
7 said value is substantially the smallest;

8 using, in common for the plurality of printing arrays,
9 substantially said selected smallest value; and

10 for substantially each array other than the particular
11 array, operating with a respective reduced number of printing
12 elements and with rescaled data, to match an actual effective
13 swath height of the particular array.

1 32. (original) The method of claim 31, wherein:

2 said smallest of said values is determined taking into
3 account the maximum available number of printing elements in
4 the corresponding array.

1 33. (original) The method of claim 25, further comprising
2 the step of:

3 after the scaling step, iterating the measuring and
4 scaling steps to allow for nonlinearity in such print-quality
5 defects.

1 34. (new) Apparatus for printing a desired image on a print-
2 ing medium, based upon input image data, by construction from
3 individual marks formed in a pixel grid; said apparatus com-
4 prising:

5 at least one multielement incremental-printing array that
6 is subject to colorant-deposition error;

7 means for measuring such colorant-deposition error of the
8 at least one array;

9 means for modifying a multicolumn, multirow numerical
10 tabulation that forms a mapping between such input image data
11 and such marks, to compensate for the measured colorant-depo-
12 sition error; and

13 means for printing using the modified mapping;

14 wherein the multielement printing array is an inkjet
15 printhead.

1 35. (new) A method of printing a desired image, by construc-
2 tion from individual marks formed in a pixel grid by at least
3 one multielement printing array that is subject to a pattern
4 of printing-density defects; said method comprising the steps
5 of:

6 measuring such pattern of printing-density defects;

7 deriving a correction pattern from the measured pattern
8 of printing-density defects;

9 applying the correction pattern to modify a halftone
10 thresholding process; and

11 printing such image using the modified halftone thresh-
12 olding process;

13 wherein the multielement printing array is an inkjet
14 printhead.

1 36. (new) A method of printing a desired image, based on
2 input image data, by construction from individual marks formed
3 in a pixel grid by at least one scanning multielement printing
4 array; said printing being subject to print-quality defects
5 due to departure of printing-medium advance from an optimum
6 value; said method comprising the steps of:

7 measuring a parameter related to such print-quality
8 defects;

9 based on the measured parameter, scaling such input image
10 data to compensate for said departure; and

11 printing such image using the scaled input image data;

12 wherein the multielement printing array is an inkjet
13 printhead.

1 37. (new) Apparatus for printing a desired image on a print-
2 ing medium, based upon input image data, by construction from
3 individual marks of at least one colorant, formed in a pixel
4 grid; said apparatus comprising:

5 for each colorant, respective means for printing incre-
6 mentally in that colorant;

7 each said printing means, for a particular one colorant,
8 comprising at least one respective incremental-printing array
9 that is subject to colorant-deposition error;

10 means for measuring such colorant-deposition error of the
11 at least one array;

12 means for modifying a multicolumn, multirow numerical
13 tabulation that forms a mapping between such input image data
14 and such marks, to compensate for the measured colorant-depo-
15 sition error; and

16 means for printing using the modified mapping.

1 38. (new) Apparatus for printing a desired image on a print-
2 ing medium, based upon input image data, by construction from
3 individual marks formed in a pixel grid; said apparatus com-
4 prising:

5 at least one multihundred-element printing array that is
6 subject to colorant-deposition error;

7 means for measuring such colorant-deposition error of the
8 at least one array;

9 means for modifying a multicolumn, multirow numerical
10 tabulation that forms a mapping between such input image data
11 and such marks, to compensate for the measured colorant-depo-
12 sition error; and

13 means for printing using the modified mapping.

1 39. (new) The apparatus of claim 38, wherein:

2 the multihundred-element array has at least three hundred
3 printing elements.

1 40. (new) Apparatus for printing a desired image on a print-
2 ing medium, based upon input image data, by construction from
3 individual marks formed in a pixel grid; said apparatus com-
4 prising:

5 at least one multielement incremental printing array,
6 having at least thirty printing elements, that is subject to
7 colorant-deposition error;

8 means for measuring such colorant-deposition error of the
9 at least one array;

10 means for modifying a multicolumn, multirow numerical
11 tabulation that forms a mapping between such input image data
12 and such marks, to compensate for the measured colorant-depo-
13 sition error; and

14 means for printing using the modified mapping.

1 41. (new) The apparatus of claim 40, wherein:

2 the at least one multielement incremental printing array
3 comprises a scanning printhead or a full-page-width printhead.

1 42. (new) The apparatus of claim 40, wherein:

2 the printing means comprise at least one microprocessor
3 controlling all of the at least thirty elements simultaneously
4 during printing to select, and selectively actuate, particular
5 elements for printing of particular pixels respectively.